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The Qur'an, Basic Scientific Research and Technology *(Perspective)*

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Abstract
Basically the Qur'an is a complete code covering all aspects of life, whether spiritual, intellectual, political, social, economic or scientific. It is a code which has no boundaries of time, place or nation. These messages are spread throughout The Qur'an in a variety of ways, such as direct stipulation, reminders of Allah's favour in His creation, stories of past communities followed by the lessons which have to be learned from them and some clues about the modern science. In this paper, from the verses of The Qur'an, it is concluded that The Qur'an encourages us to engage ourselves in basic scientific research; and once this done, we then have to look for the technological innovations and developments.

Keywords*: Big bang model, solar energy, escape velocity, flight of birds, elementary particles*

Abstrak
Asasnya, kitab al-Qur'an ialah satu kod lengkap bagi seluruh aspek kehidupan, sama ada spiritual, intelektual, politik, sosial, ekonomi atau saintifik. Kod ini tidak dibatasi oleh ruang masa, tempat atau bangsa. Mesej ini dipaparkan secara meluas dalam al-Quran melalui pelbagai cara seperti pensyaratan secara terus, peringatan tentang kemurahan Allah terhadap ciptaan-Nya, cerita tentang komuniti lampau disusuli dengan pengajaran yang perlu dipelajari dan beberapa petanda berkenaan dengan ilmu sains moden. Dalam bab ini, daripada ayat-ayat al-Qur'an, dirumuskan bahawa al-Qur'an menggalakkan kita untuk menceburkan diri dalam penyelidikan asas saintifik dan selepas itu kita perlu memikirkan inovasi teknologi dan kemajuan.

Kata kunci*: model Big bang, tenaga solar, halaju lepas, sekawan burung, zarah unsur*

Introduction

Science compels scientists to admit to the essential need of a Supreme Creator and that is why knowledge shall be propagated in the spirit of *tawhid*, which leads towards the recognition of Allah (*s.w.t.*) as the Absolute Creator and Master of mankind.

Throughout the last fourteen centuries, no book has been read so widely nor has shaped the human mind as The Qur'an. Its contents are not confined to a particular theme or style, but contains the foundations of the entire system of life. The Qur'an also encourages the quest for knowledge. In this context, consider the following first five verses which were revealed to Prophet Muhammed (*s.a.w.*):

Read (or Proclaim) In the name of thy Lord and Cherisher-Who created, Created man, out of a leech-like clot: Proclaim! And thy Lord is Most Bountiful, He Who taught (the use of) the Pen, Taught human being that Which he knew not.

[The Qur'an 96: 1-5]

Allah SWT is the Creator of everything that is present in the universe. Therefore we have to think over His creations. In the second verse, the process of creation of human being is described; and the truth and exact knowledge involved in any process of creation is just

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the definition of science. Thus, this verse clearly indicates that if we want to know the factuality, genuineness and reality of a creation, we then have to study science. Moreover, in these verses the Arabic word *Iqra* appears twice, while the Arabic word *Qalam* is mentioned only once. This means that one has to read more than once. In order to establish facts and to arrive at the right conclusion, a systematic investigation and sincere study has to be made; which in turn has to be recorded. This is what we mean by research. Summing up the message given by the above verses, we can say that The Qur'an invites us to make a sincere habit of reading, writing and carrying out research and acquire different kind of knowledge including science, self-knowledge, spiritual understanding etc.

The Qur'an was revealed in the seventh century. There are many verses in The Qur'an which describe the scientific facts, most of which were discovered only in the last one hundred years. There is a consistency in its description of various phenomena. The verses accurately describe ideas that are in agreement with the modern observations about the universe (the verses of The Qur'an that we shall be using in this paper have been labeled, for example, as 2: 32, and 96: 1-5, meaning thereby Chapter 2, Verse 32 and Chapter 96, Verses 1-5, respectively, etc.).

The Qur'an also encourages that one should develop the scientific temperament in his approach and this is clearly described in the following verse:

Behold! In the creation Of heavens and the earth, And the alternation of night and day, There are indeed signs For men of understanding,-Men who remember Allah Standing, sitting, And lying down on their sides, And contemplate the (wonders of) creation In the heavens and the earth (With the saying): Our Lord not for naught Hast Thou created (all) this! Glory to Thee! Give us salvation from Chastisement of the fire.

[The Qur'an 3 :190-191]

A true scientist always thinks over the problem with which he is working. It does not matter whether he is standing, sitting, lying or busy attending other matters. His main job is to think over the problem in a serious manner. In verse 3:190-191 there is an invitation for us to think, in the spirit of a true scientist, over the creation of heavens and the earth and the alternation of day and night. Allah (*s.w.t.*) has not created these things just for nothing. There are some specific reasons (and of course some laws) for the creation of heavens and the earth. The Qur'an is, basically, a code of conduct as evident from the following verses:

But it is nothing less than a Message to all the worlds.

[The Qur'an 68 : 52]

Verily this is no less than a Message to (all) the Worlds: (With profit) to whoever among you wills to go straight.

[The Qur'an 81 : 27-28]

But there are number of verses in The Qur'an which compel us to think over the signs of Allah (*s.w.t.*), for example:

And this is the path of your Lord, [leading] straight. We have detailed the verses for a people who remember.

[The Qur'an 6 : 126]

And it is He who spread the earth and placed therein firmly set mountains and rivers; and from all of the fruits He made therein two mates; He causes the night to cover the day. Indeed in that are signs for a people who give though.

[The Qur'an 13 : 3]

It is He who sends down rain from the sky; from it is drink and from it is foliage in which you pasture [animals]. He causes to grow for you thereby the crops, olives, palm trees, grapevines, and from all the fruits. Indeed in that is a sign for a people who give thought. And He has subjected for you the night and day and the sun and moon, and the stars are subjected by His command. Indeed in that are signs for a people who reason. And [He has subjected] whatever He multiplied for you on the earth of varying colors. Indeed in that is a sign for a people who remember.

[The Qur'an 16 : 10-13]

Allah (*s.w.t.*) is the Absolute Creator of everything and he created them with a law as can be seen from the following verses of The Qur'an:

He to whom belongs the dominion of the heavens and the earth: no son has He begotten, nor has He a partner

in His dominion: it is He who created all things, and Ordered them in due proportions.

[The Qur'an 25 : 2]

Allah created the heavens and the earth in true (proportions): verily in that is a Sign for those who believe.

[The Qur'an 29 : 44]

Allah is Creator of all things, and He is Guardian over all things. To Him belong the keys of the heavens and the earth: and those who reject the Signs of Allah,- it is they who will be in loss.

[The Qur'an 39 : 62-63]

These verses clearly show that each and every law of creation is in fact the law of Allah (*s.w.t.*), and we can discover them because Allah (*s.w.t.*) has given us the ability to do so:

Taught human being that which he knew not;

[The Qur'an 96:1-5]

This paper, through the verses of The Qur'an, it is concludes that The Qur'an invites us to get ourselves involved in basic scientific research; and to make use of it for the service of mankind. Therefore, we have to develop the right kind of technology.

2. The beginning

Modern cosmology got its impetus in the 1920s for two reasons. One was the general theory of relativity proposed by Albert Einstein in 1915. The other was the important discovery by Edwin Hubble of the so called "red-shift"- a remarkable property of light received from distant galaxies. It is said that the general theory of relativity laid the foundations of modern theoretical cosmology, while the Hubble's discovery is responsible for launching the modern observational cosmology (for a detailed discussion of general theory of relativity, the reader is referred to Narlikar 1978, 1993). Cosmologists have obtained a number of models of the universe (for different models of the universe, see Ahsan 2004a). All these models, except the steady-state model, share a simplifying assumption that the universe as seen from any galaxy at any given time looks the same in all directions and looks the same as seen from any other galaxy. In other words, no position or direction in the universe is specially privileged. This is known as cosmological principle. Technically speaking, the cosmological principle means that the universe is homogeneous and isotropic at a given cosmic time. The steady-state model is based on a principle, known as perfect cosmological principle, which states that the universe looks same at all cosmic times. This new cosmological principle guarantees uniformity of structure not only in space but also in time (for further details, see Narlikar 1993).

The Big-bang Model:

Even before the concept of expanding universe, theoretical cosmologists, in 1920s, were exploring the solutions of Einstein's field equations. Einstein himself obtained the cosmological solutions of his field equations with a hope to describe the large scale structure of the universe in a simplified manner. The Einstein model of the universe related the curvature of the space to the density of the matter present in the space - thus emphasizing the central theme of general relativity that the space-time geometry and matter distribution are related to each other. Einstein also showed that the space-time is curved and its curvature increases wherever an object having mass is present. The Einstein's model is static and is characterized by matter without motion. Later on, de Sitter obtained another simple model of the universe, which was empty but expanding and has motion without matter. In both these models there is a force of repulsion. By 1922, Friedmann obtained the expanding cosmological solution of Einstein field equations without considering the force of repulsion. Since then a lot of work has been done on Friedmann models.

Around 1940s G. Gamow assumed that the universe was created with a big explosion and that very high temperature existed in the early stages after this big explosion. Only within few moments after the creation of the universe, the elementary particles were formed. The universe which came into existence in this manner is now popularly known as *Big Bang* universe and is described as follows:

There was an instant, a finite time ago (say, $t = 0$), the universe burst out into existence out of a point. At that instant (i.e., at $t = 0$), all the matter and radiation in the universe poured out of this point in the form of a very big explosion. The debris of the explosion moved apart with very large velocities. The gravitational pull between then the constituents of the universe put a halt on this motion and consequently brings the state of expansion to the state of contraction, depending upon

the geometric properties of the space (only if the curvature of the space is positive). The instant $t = 0$ may be regarded as the *event of creation*. There was no universe, no observer and no physical laws before $t=0$. The time that has elapsed since the event of creation is known as the *age* of the universe and with the present available astronomical data it is estimated about 14 billion years.

The creation event is believed to have occurred in a 'singular' fashion. That is, at this instant, the equations of relativity, or of any physical theory breaks down and thus no scientific investigation of this event is possible. However, a good amount of work has been done on what happened just after $t = 0$. The creation of particles was started at $t = 10^{-43}$ *sec* (Narlikar 1993). This time is known as Planck's time. It is believed that just after $t = 0$ (i.e., the early universe), the universe was largely made up of high intensity radiation rather than matter. The intensity of radiation reduced more rapidly than the density of matter due to the subsequent expansion of the universe. Thus, in the early stage, the universe was radiation dominated while at present it is in the matter dominated state.

Any scientific theory is accepted only when it is supported by experiment - the big bang theory now requires experimental verification. About the importance of experiment, The Qur'an says:

When Abraham said: "Show me, Lord, how You will raise the dead, " He replied: "Have you no faith?" He said "Yes, but just to reassure my heart." Allah said, "Take four birds, draw them to you, and cut their bodies to pieces. Scatter them over the mountain-tops, then call them back. They will come swiftly to you. Know that Allah is Mighty, Wise."

[The Qur'an 2: 260]

In this verse, four birds can be regarded as the apparatus for the experiment; and the training and cutting the birds into pieces, scattering them on mountain and then calling back is the method for performing the experiment. That is, in order to verify a theory one has to perform an experiment

Since the early universe was filled up only with radiation, a faint microwave background radiation should also exist at present. This background radiation was detected by A. A. Penzias and R. W. Wilson, from Bell Labs. in USA, in 1965. The temperature of the radiation is estimated as about *3 K*. This provides a strong observational evidence for the big-bang theory of the universe. Recently (2003-2010), the big bang theory was further verified by an experiment known as the Wilkinson Microwave Anisotropy Probe (WMAP) [also known as the Microwave Anisotropy Probe (MAP)], and Explorer 80. This is a spacecraft which measures differences in the temperature of the Big Bang's remnant radiant heat and the Cosmic Microwave Background Radiation (CMBR) across the full sky. Thus, big bang theory is verified and hence accepted. Now let us see how The Qur'an describes the creation of the universe. The Qur'an says

Do not the Unbelievers see that the heavens and the earth were joined together (as one unit of creation), before we clove them asunder? We made from water every living thing. Will they not then believe?

[The Qur'an 21: 30]

In this verse, there are two words 'Rataq' (joined together as one unit) and 'Fataq' (blown into pieces with high speed). This verse clearly points towards the event when all the matter and radiation poured out from a single point in the form of a big explosion (splitted apart in pieces with heavy blow). This is now commonly known as Big Bang. Thus the concept of big bang was mentioned in The Qur'an some fourteen hundred years ago, which the modern science has discovered only few years back.

From these discussions it is clear that in order to get the knowledge how our universe was created, we have to search for the scientific reasons; and once a theory is formulated, we then have to verify it through experiments for which the appropriate technology has to be built.

3. Pure scientific research

It is He who sends down upon His Servant [Muhammad] verses of clear evidence that He may bring you out from darknesses into the light. And indeed, Allah is to you Kind and Merciful.

[The Qur'an 57: 9]

The messages given in The Qur'an are meant to bring us out of the darkness so that we can reach the known facts. That is by involving ourselves in pure scientific research, we can discover the mysteries of the creations. For example, consider the following verses from The Qur'an

But those who disbelieved - their deeds are like a mirage in a lowland which a thirsty one thinks is water until, when he comes to it, he finds it is nothing but finds Allah before Him, and He will pay him in full his due; and Allah is swift in account.

[The Qur'an 24: 39]

In this verse, the Arabic word '*sarab*' is used which has the meaning of 'moving sand'. If we read this verse carefully we can instantly notice that the phenomenon of mirage is described. This phenomenon is mentioned as follows:

A mirage is a naturally occurring optical phenomenon in which light rays are bent to produce a displaced image of distant objects or the sky. Cold air is denser than warm air and has therefore a greater refractive index. As light passes from colder air across a sharp boundary to significantly warmer air, the light rays bend away from the direction of the temperature gradient. When light rays pass from hotter to colder, they bend toward the direction of the gradient. If the air at lower level is warmer than the higher level, the light ray bends in a concave, upward trajectory. Once the rays reach the viewer's eye, the visual cortex interprets it as if it traces back along a perfectly straight "line of sight". This line is however at a tangent to the path the ray takes at the point it reaches the eye. The result is that an "inferior image" of the sky above appears on the ground. The viewer may incorrectly interpret this sight as water which is reflecting the sky. In the case where the air near the ground is cooler than higher ground, the light rays curve downward, producing a "superior image". In the inferior mirage, the image seen is under the real object. The real object is the (blue) sky or any distant object in that direction, meaning we see a bright bluish patch on the ground in the distance. For exhausted travelers in the desert it appears as a lake of water. On tarmac roads it may seem that water or even oil has been spilled. This is called a "desert mirage" or "highway mirage". Note that both sand and tarmac can become very hot when exposed to the sun, easily being more than 10°C hotter than the air one meter above, enough to cause the mirage. Light rays coming from a particular distant object all travel through nearly the same air layers and all are bent over about the same amount. Therefore rays coming from the top of the object will arrive lower than those from the bottom. The image usually is upside down, enhancing the illusion that the sky image seen in the distance is really a water or oil puddle acting as a mirror.

The phenomenon of mirage may find a place in the writings of Ibn al-Haytham. *Abū ʿAlī al-Ḥasan ibn al-Ḥasan ibn al-Haytham* (born in Basra in 965 AD and died in Cairo in 1040) was famous for his work in optics, where he discussed the propagation of light rays in different mediums. Ibn al-Haytham was a devoted Muslim but even then it is not clear whether he got the inspirations for his discoveries from The Qur'an or just got them by observations and experiments. Nevertheless, the message given in the verse 24: 39 is very clear. Ibn al-Haytham was an Arab scientist who made significant contributions in anatomy, astronomy, engineering, mathematics, medicine, ophthalmology, philosophy, physics, psychology, visual perception and to science in general with his early applications of scientific method. His most famous work is his seven volume Arabic Treatise on Optics, *Kitab al-Manazir* (Book of Optics) written from 1011 to 1021**.** Ibn al-Haytham proved that rays of light travel in straight lines, and carried out various experiments with lenses (*adasa*), mirrors, refraction, and reflection. He was also the first to decompose reflected and refracted light rays into vertical and horizontal components, which was a fundamental development in geometric optics. Ibn al-Haytham also gave the first clear description and correct analysis of the camera obscure and pinhole camera. His most original anatomical contribution was his description of the functional anatomy of the eye as an optical system, or optical instrument.[1]

4. Scientific research and technology

Everything that is created by Allah (*s.w.t.*) is in the service of human being. In Qur'an, Allah (*s.w.t.*) says:

And He has subjected to you whatever is in the heavens and whatever is on the earth - all from Him. Indeed in that are signs for a people who give thought.

[The Qur'an 45: 13]

It is Allah who created the heavens and the earth and sent down rain from the sky and produced thereby some fruits as provision for you and subjected for you the ships to sail through the sea by His command and

subjected for you the rivers. And He subjected for you the sun and the moon, continuous [in orbit], and subjected for you the night and the day.

[The Qur'an 14: 32-33]

We can get the benefits of each and every creation of Allah (*s.w.t.*), if we know the working rule of that particular creation or more specifically if we can find the scientific process involved in the working of that particular creation. In this section, with the help of the verses from The Qur'an, we shall find that how The Qur'an encourages us to get involved in the basic scientific research and once the scientific facts (truth and exact knowledge) about a particular creation of Allah (s.w.t) are known then we have to developed the methods or technology in order to get maximum benefits from that particular creation. Here, we shall consider a few examples.

a. Solar Energy

There are number of verses in The Qur'an which mention that Allah (*s.w.t.*) subjected the sun for us. Some of the verses are as follows:

And He hath made subject To you the sun and the moon, Both diligently persuing Their courses; and the Night And the Day hath He (also) Made subject to you

[The Qur'an 14: 33]

He has made subject to you The night and the Day; The Sun and the Moon; And the Stars are in subjection By His Command: verily In this are Signs For men who are wise.

[The Qur'an 16: 12]

Sees thou not that Allah merges Night into Day And He merges Day into Night; That He has subjected the sun And the moon (to His Law), each running its course For a term appointed; and That Allah is well acquainted With all that ye do?

[The Qur'an 31: 29]

He merges Night into Day, And He merges Day Into Night, and He has Subjected the sun and The moon (to His Law): Each one runs its course For a term appointed. Such is Allah your Lord:

[The Qur'an 35: 13]

He created the heavens And the earth in true (proportions): He makes the Night Overlap the Day, and the Day Overlap the Night: He has subjected The sun and the moon (To His law): each one follows a course For a time appointed. Is not He the Exalted In Power - He Who forgives Again and again?

[The Qur'an 39: 5]

These verses clearly show that the sun (and the other objects too) is created for the benefit of human beings. The sun is a star. It is the largest object in our solar system and the energy that comes from the sun to the earth is in two main forms - heat and light. Now, in order to get the maximum amount of energy from the sun we first have to understand how the sun shines. Once this is known then we have to look for the appropriate technology to trap the light and heat of the sun for our use. With regard to the sun, The Qur'an says:

It is He who made the sun To be a shinning glory.

[The Qur'an 10: 5]

Blessed is He Who made Constellations in the skies, And placed therein a Lamp And a Moon giving light;

[The Qur'an 25: 61]

See ye not How Allah has created The seven heavens One above another, And made the moon A light in their midst, And made the sun as A (Glorious) Lamp?

[The Qur'an 71: 15-16]

And placed (therein) A blazing Lamp.

[The Qur'an 78: 3]

In verse *10: 5* of the Qur'an, the Arabic word *dhiya* is used for sun which means 'own light', that is the sun has got its own light. In verse *25: 61*, the Arabic word *siraj* (which means Lamp) is used for the sun; while in verses *71: 15-16* and *78:3*, the sun is mentioned as a glorious and blazing lamp. Thus, from these verses it is clear that the sun is a lamp which is shinning due to its own light, but for a blazing lamp a proper fuel is required. Since in space oxygen based combustion is

not allowed, so what should be the nature of the fuel that keep the lamp (the sun) shinning continuously. The hint for such a fuel is mentioned in the following verse of The Qur'an:

> *Allah is the Light Of the heavens and the earth. The parable of His light Is as if there were a Niche And within it a Lamp: The lamp enclosed in Glass: The glass as it were A brilliant star: Lit from a blessed Tree, An olive, neither of the East Nor of the West, Whose Oil is well-neigh Luminous, Though fire scarce touched it: Light upon Light! Allah doth guide Whom He will to His Light: Allah dot set forth Parables For men: and Allah Doth know all things*.
>
> [The Qur'an 25: 35]

In this verse, the lamp (enclosed in a glass) is shinning like a brilliant star whose fuel can lit (ignite) itself even though the fire has not touched it. Such a fuel is the nuclear fuel produced by the nuclear fusion reaction which is explained as follows:

The process by means of which two or more nuclei of lighter atoms combine to form a heavy nucleus with a release of enormous amount of energy is called nuclear fusion. In this reaction, lighter nuclei fuse in the star to produce heavier nuclei with the release of a large quantity of heat; and the chemical equation for such reaction is

$$4\left({}_{1}^{1}\mathrm{H}\right) \rightarrow \left({}_{2}^{4}\mathrm{He}\right) + 2\left({}_{0}^{1}\mathrm{e}\right) + \mathrm{Q}$$

Here four protons (nuclei of hydrogen atom) fuse to give helium nuclei, two positrons (positive electrons) and a large amount of heat Q. For fusion reaction to begin in star, the star should have a minimum temperature requirement of 4×10^6 $^{\circ}C$ (cf., Narlikar 1993).

It is known that the sun is a ball of flaming gases containing 70 percent of hydrogen, 28 percent of helium and 2 percent of heavier gases like carbon, nitrogen, oxygen etc. The radius of the sun is almost hundred times that of the earth (radius of the earth is *6378.14 km*) and the mass about a million times that of earth (mass of the earth is 6×10^{24} *kg*). The surface temperature of the sun is $6000\,^{\circ}C$, while the temperature at the centre is 15×10^6 $^{\circ}C$ and the density at the centre is 10^4 kg/m^3 . Very high temperature on the sun's centre and very high pressure on it provide ideal conditions for nuclear fusion. Since the sun is a star, almost all the stars produce their energy through the process of nuclear fusion and hence we can say, in the light of these discussions and verses 10:5, *25: 61,* 71:15-16, 78:3 and 25:35 that: *The sun is shinning due to its own light which is produced through the nuclear fusion reaction.*

Thus the sun is a big ball of heat and light resulting from nuclear fusion at its core. The nuclear reaction releases energy that travels outward to the surface of the Sun. Along the way to the surface the energy transforms so that by the time it is released it is primarily light energy. The two major types of solar energy that make it to earth are heat and light. Solar energy is often called "alternative energy" to fossil fuel energy sources such as oil and coal. The earth is the third planet from the sun at a distance of about *93,000,000 (93 million) miles*. The light energy takes only *8½* minutes to reach the earth from the surface of the sun, and travels at the speed of light. Every hour, enough sunlight energy reaches the earth to meet the world's energy demand for a whole year. The amount of energy from the sun that reaches the earth annually is 4×10^{18} *Joules*, while the amount of energy consumed annually by the world's population is about 3×10^{14} *Joules*.

As man faces impending exhaustion of fossil fuels like oil and gas, solar energy has emerged as the most viable source of power. It is the best natural resource that can fuel the energy needs of man and provide clean and cheap power for many millennia without fail. It is the most preferred form of renewable energy in the world today and tremendous research has made it easy to harness the potential of the sun and power the planet in the most eco-friendly way.

One example of our use of solar heat energy is for water heating system. A solar panel is used to collect heat. The heat is transferred to pipes inside the solar panel and water is heated as it passes through the pipes. The hot water, heated by the Sun, can then be used for showers, cleaning, or heating our home. We also use solar thermal energy through passive solar designs. Windows or skylights in our home can be designed to face the sun so that they let heat into the house, keeping us warmer in the winter.

The light energy (solar power) from the Sun can be transformed into electrical energy and used immediately or stored in batteries. Photovoltaic (PV) panels are the devices that convert light energy into electrical energy. The first long-term practical application of PV cells was in satellite systems. In 1958 the Vanguard I, was launched into space. It was

the first orbiting vehicle to be powered by solar energy. Photovoltaic silicon solar cells provided the electrical power to the satellite until 1964 when the system was shut down. The solar power system was so successful that PV's have been a part of world-wide satellite space programs ever since. The sun provides endless nonpolluting energy to the satellite power systems and demand for solar cells has risen as a result of the telecommunications revolution and need for satellites. Nowadays solar power has a number of applications – some of the applications includes railroads, lighthouses, off-shore oil rigs, buoys, and remote homes. For some countries and many applications, solar energy is now considered a primary energy source and not as an alternative.

Thus, from the verses of The Qur'an and the above discussion, it is very much clear that if we really want to benefit from the creations of Allah (*s.w.t.*) (here, for instant we have taken the sun) then, first of all we have to work for the details (the basic scientific research) of that particular creation and secondly to make it useable for mankind. This means that we have to built the right kind of technology.

b. Escape velocity

Consider the following verse of The Qur'an

O assembly of jinns and men! If you have power to pass beyond the zones of the heavens and the earth, then pass (them)! But you will never be able to pass them, except with authority (from Allah)!

[The Qur'an 55:33]

In this verse, Allah (*s.w.t.*) is addressing the group of human being and jinns that if they want to leave the boundaries of earth (a planet) or that of heaven, they can do that only if they have got enough power (which has been fixed by Allah). In terms of scientific language, we can say that if we want to leave the gravitational field of a planet (or a celestial object), then we have to achieve a certain amount of speed (which has been fixed by Allah (*s.w.t.*) for each and every heavenly body). We can discover this speed, because Allah (*s.w.t*) has given us the ability and facility to do so [*Taught human being that which he knew not. (The Qur'an 96:5)*]. In other words, first we have to find a formula (basic scientific research) that will give us the required amount of speed needed to leave the boundaries of the planet (or the celestial body) and then we have to develop the right kind of technology where this formula can be used.

The minimum amount of speed required to escape from the gravitational field of a heavenly body is known as its escape velocity. Neglecting the frictional resistance, if the kinetic energy of an object, that is launched from the earth (or any planet/heavenly body), is equal in magnitude to the potential energy. Only then, the object will leave the gravitational field of the earth (or any planet/heavenly body). That is

$$\frac{1}{2}\, mv^2 = \frac{G\, M\, m}{r}$$

which leads to

$$v_{\,escape} = \sqrt{2\, G \frac{M}{r}}$$

where G is the gravitational constant, M, the mass of the earth and r is the radius of the earth. In proper units, the escape velocity for earth is *11.2 km/sec*. (cf., Ahsan 2004). That is, if we want to leave the gravitational field of earth then we have to built a machine that can achieve the velocity greater than or equal to *11.2 km/sec*. The first man made machine that achieved the escape velocity from the earth was Luna 1 (built by Russians) and was launched in 1959. Since then, a number of rockets have been made for space travel.

c. Detection of Radiation

Now consider the following verses from The Qur'an

It is the fire of Allah [eternally fueled], Which mounts directed at the hearts.

[The Qur'an 104 : 6-7]

In this verse, the fire (which is created by Allah) can be considered as a form of radiation and the heart can be considered an organ (of human being); so the radiation is hitting a particular object. Now every radiation has its own frequency (that has been fixed by Allah), we can detect this frequency by the facility given to us by Allah (s.w.t.) [Taught human being which he knew not. (The Qur'an 96 : 5)] and then make use of it. The detection of such type of frequency involve basic scientific research and to use it for the benefit of human being, we have to develop the right kind of technology. The most simple example of this effect is the microwave

oven, where the radiation hits the food particles. That is, we have found a particular type of frequency (radiation) that can hit the object of our choice (the food, in this case - the utensil in which the food is kept remain unaffected by the radiation).

A microwave oven, or simply a microwave, is a kitchen appliance that heats food by dielectric heating. This is accomplished by using microwave radiation to heat polarized molecules within the food. This excitation is fairly uniform, leading to food being more evenly heated throughout (except in dense objects) than generally occurs in other cooking techniques. The first personal microwave was introduced in 1967 by the Amana Corporation in U.S.A. A microwave oven works by passing non-ionizing microwave radiation, usually at a frequency of 2.45 gigahertz (GHz)—a wavelength of 122 mm (4.80 in)—through the food. Microwave radiation is between common radio and infrared frequencies. Water, fat and other substances in the food absorb energy from the microwaves in a process called dielectric heating. Many molecules (such as those of water) are electric dipoles, meaning that they have a positive charge at one end and a negative charge at the other, and therefore rotate as they try to align themselves with the alternating electric field of the microwaves. This molecular movement represents heat which is then dispersed as the rotating molecules hitting other molecules and putting them into motion. Another example of such frequency and its use is radiation therapy which involves treating disease with penetrating beams of high-energy radiation. It is used to treat cancer, while performing surgery and/or chemotherapy.

d. Birds Flight

We have been observing how birds fly. They do such wonderful things: taking off, flying with twists and turns, soaring, diving and landing again on a small branch. Fossil records show that birds have been flying for millions of years. Birds are unique creatures. In the animal kingdom, there are two reasons that make birds special. First, all birds have feathers, and second, all birds live in a hurry. Everything about a bird is fast. They breathe faster than any other animal. Their heart beats faster and their body temperature is higher. Birds have backbones and are warm blooded. This means that their body temperature remains the same even in differing temperatures. Birds lay eggs and defend themselves with a bill or a beak. All birds have wings, but not all birds fly. There are more than 8,600 species of birds in the world today and they are found everywhere. Birds play a vital role in the balance of nature; they eat insects, pests and small animals. Birds also have other values. We eat both eggs and meat from birds, their feathers are used for pillows, quilts and clothing. We also like the beauty of the bird and have written poetry, stories and songs on them. About the birds, Allah (*s.w.t.*) says in The Qur'an that

Do they not see the birds controlled in the atmosphere of the sky? None holds them up except Allah. Indeed in that are signs for people who believe.

[The Qur'an 16 : 79]

Do they not see the birds above them with wings outspread and [sometimes] folded in? None holds them [aloft] except the Most Merciful. Indeed He is, of all things, Seeing.

[The Qur'an 67 : 19]

Through these verses we have been invited to think over the controlled motion of the birds in the air (sky). These birds are flying in such a manner that they are not get attracted toward the earth (they are flying against the gravity of the earth), so there must be some reason or law by means of which the birds are flying. This law has been fixed by Allah (*s.w.t.*) and we can discover this because Allah (*s.w.t.*) has given us the ability to do so. We have to realize that we could not fly just like a bird as we are not made in that way. Everything about a bird is made for flight. In order to understand the natural flight of birds, we must first look at the structure of a bird. What makes a bird a bird? We must explore the earliest birds and look at the actual mechanics of flying. In this way we can understand how birds take off, fly and land. Now the investigation of the mechanism of bird's flight means that we to have to engage ourselves in basic scientific research about the birds. Once the actual reasons involved in the process of flight of birds are known, we then have to develop the right kind of technology so as to enable us to built a machine that can fly like a bird. By understanding the mechanism of flight of different kinds of birds, we have made different kinds of flying machines. Thus, for example, the mechanism of flight of eagles/vultures have led us to built big aero planes, the flight of roseate tern (a specie of seagulls) led to the making of fighter plane and flight mechanism of hummingbirds to helicopters, etc.

e. Elementary Particles

For quite some time in the past it was believed that atom was unbreakable, and thus hydrogen atom enjoyed the place of being the smallest particle. But at the beginning of twentieth century, it was discovered that atoms are made up of protons, neutrons and electrons. Today we know that the electron is really indivisible, while protons and neutrons appear to be built out of much smaller particles. An understanding of such small particles gives us a better insight in the physics of the universe.

The Qur'an, on the other hand, some fourteen hundred years ago has mentioned the existence of smaller particles (now we call them as elementary particles) as is evident from the following verse; in which Allah (*s.w.t.*) says that nothing is hidden from His Sight even if it is smaller than the size of an atom:

In whatever business thou mayest be, and whatever portion thou mayest be reciting from the Qur'an,- and whatever deed ye (mankind) may be doing,- We are witnesses thereof when ye are deeply engrossed therein. Nor is hidden from thy Lord (so much as) the weight of an atom on the earth or in heaven. And not the least and not the greatest of these things but are recorded in a clear record.

(The Qur'an 10 : 61)

This verse clearly shows that atom is not the smallest particle and is breakable. The discovery of these new broken parts, known as elementary particles, now involves the process of basic scientific research; and once this is done we then have to look for the appropriate technology to detect them.

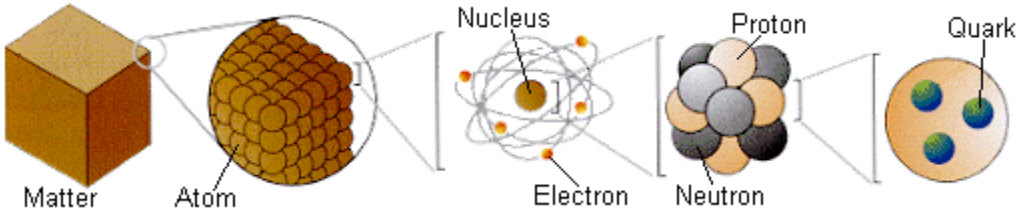
Protons, neutrons and electrons are only three of the more than two hundred subatomic particles that are known. These elementary particles are the most basic physical constituents of the universe and are helpful in determining the four fundamental forces of nature. In modern physics, the elementary particles are described by the standard model, categorizes in three basic families: the electron-like, the muon-like and the tau-like. Every family has four members, two leptons and two quarks. For every type of particle of one family there is a similar particle from the other two families that only differs in mass. An essential difference between quarks and leptons is their electrical charge. Following diagram (Figures 1 and 2) will illustrate the elementary particles and their role in understanding the universe (for further details see, Bettini 2008).

These particles are demonstrated on laboratory scale in so called particle accelerators. Here atom nuclei are brought into collision at very high velocities by which matter particles and their anti-matter particles come into being, with every neutron an anti-neutron and with every proton an anti-proton. Another technological innovation that has recently been done, in this direction, is the installation of large hadron collider (LHC); a brief account of which is as follows:

The Large Hadron Collider (LHC) is the world's largest and highest-energy particle accelerator, intended to collide opposing particle beams of either protons at an energy of 7 TeV per particle, or lead nuclei at an energy of 574 TeV per nucleus. It is expected that it will address the most fundamental questions of physics, questions concerning the basic laws governing the interactions and forces among the elementary objects, the deep structure of space and time, especially regarding the intersection of quantum mechanics and general relativity, where current theories and knowledge are unclear or break down altogether. The LHC lies in a tunnel 27 kilometers in circumference, as much as 175 meters beneath the Franco-Swiss border near Geneva, Switzerland. The LHC was built by the European Organization for Nuclear Research (CERN) with the intention of testing various predictions of high-energy physics, including the existence of the hypothesized Higgs boson and of the large family of new particles predicted by super symmetry.

The Standard Model

The Standard model is the ruling model that describes the world of the subatomic particles and interactions.



	LEPTONS		QUARKS	
Matter-particles: all common particles	**Electron** *Charge: -1* Responsible for electricity and chemical reactions.	**Electron-neutrino** *Charge: none.* Also possibly no mass. Move by billions per second through our body.	**Quark-Up** *Charge: +2/3.* Protons contain two, neutrons one.	**Quark-Down** *Charge: -1/3.* Protons contain one, neutrons two.
These particles existed immediately after the Big Bang. Now they are found by nature only in cosmic radiation.	**Muon** A more heavy variant of the electron. Exists only one two millionth part of a second.	**Muon-neutrino** Comes into existence together with muons when particles fall apart.	**Quark-Charm** More heavy relation of the up-quark.	**Quark-Strange** More heavy relation of the down-quark.
	Tau More heavy than Muon. Very unstable.	**Tau-neutrino** Not yet discovered. The existence is assumed.	**Quark-Top** More heavy than Charm.	**Quark-Bottom** More heavy than Strange.

Figure 1: Standard Model

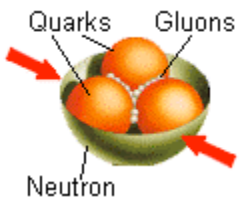
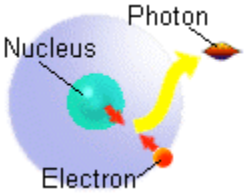
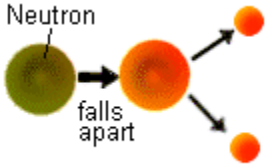
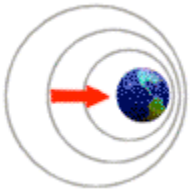
Force-particles: Bearers of the four fundamental interactions of nature.	**Gluons** Bearers of the **strong nuclear force** of quarks.	**Photons** Light particles. Bearers of the **electromagnetic force**.	**Intermediate vector bosons** W and Z particles. Bearers of the **weak nuclear forces.**	**Gravitons** Bearers of the **gravitational forces**. Hypothetical, Gravitons are not yet discovered.
				
The release of nuclear energy during nuclear reactions is a result of the strong nuclear force.	Electricity, magnetism and chemistry are results of the electro-magnetic force.	Some forms of radioactivity are a result of the weak nuclear force.	Our experience of 'weight' is a result of the gravitational force.	

Figure 2: Force Particles

Conclusion

Every thing that is created by Allah (*s.w.t.*) is in the service of mankind (cf., The Qur'an 45:13). If we want to get the benefits of these creations we then have to understand their working rules. That is, first of all we have to look for the scientific reasons involved in the working of that particular creation; and once this is done we then have to develop the right kind of technology to get maximum benefits from that particular creations. There are numerous verses in The Qur'an which compel us to think and work in this direction. In this paper, due to limited space, we have considered only few examples. These examples clearly demonstrate that if we really want to use the creations of Allah (*s.w.t.*) for the benefits of human beings then we must engage ourselves in basic scientific research and technology. *Thus, for gaining access to the effulgence and closeness to Allah (s.w.t.), there is no better way than that of searching for truth and knowledge (Basic Scientific Research and Technology).*

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[1] For further details about the work of Ibn al- Haytham, see http://en.wikipedia.org/wiki/Alhazen and the references therein

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